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THE PULSE IN INSANITY.

Original Study of Cases.

presented by the author

BY

THEO. H. KELLOGG, M. D.

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THE PULSE IN INSANITY--ORIGINAL STUDY OF CASES.

The circulation of the blood in the human system is a simple matter as explained by the application of definite mechanical laws, but it is a most complex biological problem when considered as completely controlled by vital forces generated in the cerebro-spinal and sympathetic nervous centres.

The older medical authors discoursed voluminously and not altogether impractically about the characters of the pulse in various diseases, and since the introduction of the sphygmograph modern writers have described at length the diagnostic and prognostic value of the pulse and its variations in pathological states of the body.

Several contributions have been made to the study of the Pulse in Insanity, but the literature of the subject is not very large and it is repetitious, to a considerable degree of conclusions arrived at by Wolff in an article published in Germany many years ago. The general opinion of these writers is that mania, melancholia and dementia, and each of the other common forms of insanity, has a characteristic kind of pulse and pulse tracings and that as the mental disease becomes chronic the pulse is dicrotic and then monocrotic in the terminal stages.

After making efforts to confirm the chief conclusions just mentioned the writer by much study of his cases is forced to believe in a decidedly more complicated state of pulse phenomena in insanity. Not only do different stages of the same form of insanity present different kinds of pulse, but different individuals passing through the same phase of mental disorder furnish different pulse records. In fact, if all previous observers of pulse-phenomena had taken individuals as physically constituted, rather than forms of insanity, as a basis for classification, the conclusions arrived at would have been more reliable. Reasoning a priori, is it for a moment to be concluded that because suffering from melancholia, for instance, a young man would furnish a pulse like an old one, or a fat person like a lean one, or a patient of powerful muscular development like

one emaciated, or that a plethoric, melancholic woman would yield a sphygmographic tracing like one depleted of her fluids in puerperal melancholia?

It is upon the physical constitution of the patient, the etiology of the case, and the stadium of the mental disorder rather than upon the form of the insanity, that the kind of pulse is to be predicated.

Time and space will not permit a further mention of the views of others about the pulse in insanity. The conclusions of this article, based on a study continued interruptedly through a series of years in a large number of cases, will be given somewhat summarily under two heads, as follows :

* First, the frequency of the pulse. Second, the sphygmographic characters of the pulse.

The study of the pulse rate here given consisted in the registration of its frequency in twenty-one hundred and seventy-two cases. Eleven hundred and thirty-two of these cases were females, and ten hundred and forty were males, and they were of all ages and forms of mental disorder. The pulse was taken before the midday meal and in the sitting posture, and was verified a second time in doubtful cases; and in every instance the pulse was counted throughout an entire minute. These individual records were then, for the sake of analysis, arranged by decades of frequency beginning with that from 40 to 50 and ending with that from 130 to 140, showing the number of men and women respectively and the total number of patients whose pulse rate fell by count within the various decades from 40 to 140.

This analysis is here shown in tabular form :

TABLE NO. I.

Pulse frequency by decades in 2172 patients.											
Decades	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100	100 to 110	110 to 120	120 to 130	130 to 140	Totals.
Number women		9	96	307	344	217	103	33	21	2	1132
Number men...	3	14	120	365	294	150	70	12	12		1040
Grand totals...	3	23	216	672	638	367	173	45	33	2	2172

It appears from this table that out of twenty-one hundred and seventy-two patients, three had a pulse from forty to fifty per minute, twenty-three from fifty to sixty, two hundred and sixteen from sixty to seventy, six hundred and seventy-two from seventy to eighty, six hundred and thirty-eight from eighty to ninety, three hundred and sixty-seven from ninety to one hundred, one hundred and seventy-three from one hundred to one hundred and ten, forty-five from one hundred and ten to one hundred and twenty, thirty-three from one hundred and twenty to one hundred and thirty, and two from one hundred and thirty to one hundred and forty per minute.

It is also obvious, from a glance at this table, that a majority of the female patients and a very much larger proportion of women than men had a pulse in the decades above eighty.

The following table, No. II, will also show the separate and total percentages of the sexes in the various decades of pulse frequency :

TABLE NO. II.

Percentages of pulse frequency by decades.										
Decades..	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100	100 to 110	110 to 120	120 to 130	130 to 140
Per cent. women		.008	.085	.27	.30	.19	.09	.029	.0185	.0017
Per cent. men003	.0134	.115	.35	.28	.145	.067	.0115	.0115	
Total Per ct...	.0014	.0106	.10	.30	.293	.14	.08	.02	.015	.001

It becomes at once evident by this table that there are contained in the decade of frequency 70 to 80, thirty-five per cent. of the men and only twenty-seven per cent. of the women, while on the contrary in the decade 80 to 90 there are thirty per cent. of the women and only twenty-eight per cent. of the men. It also appears that the percentages were relatively larger in the four decades immediately above eighty than in the four consecutively below it.

The salient feature of this diagram is that the male pulse curve reaches its highest numerical point at 70, and the female curve not until one decade later at 80, while the total pulse curve attains its

maximum height at the decade of frequency beginning with seventy beats per minute.

Finally to complete the study of pulse frequency, a table of average rates in the two sexes and also for the total 2172 patients, is here given.

TABLE NO. III.

Table of averages of pulse rate in 2172 insane patients.	
Average pulse rate in 1132 women.....	84.8
Average pulse rate in 1040 men.....	80.8
General average pulse rate in the 2172 patients.....	82.8

Admitting the average pulse in adult males to be seventy-two, and that of females seventy-eight per minute, the tabular information above given leads to the conclusion that there is a marked average increase of pulse rate in insanity. The actual increase over the physiological norm mentioned would be 6.8 beats per minute for the females and 8.8 for the males.

The statistical figures here given are derived from such a large number of cases that it may be safely admitted that in established cases of insanity there is, on the average, a decided increase in pulse rate.

To what degree pulse variations in the insane are due to pneumogastric disorder has already been described by the writer in an article read last year before the American Medico Psychological Association, and entitled "Frequent Disorder of Pneumogastric Functions in Insanity." Both quantitative and qualitative pulse variations are often to be attributed to this source in case of mental disorder.

The sphygmographic characters of the pulse in insanity will now be considered.

For convenience of comparison of our own conclusions with those arrived at by other writers, this part of the subject will be divided according to the chief forms of insanity, though, as already intimated, there is nothing inherent in the clinical findings which demands such a division.

To begin with then, let the sphygmographic tracings of the pulse in mania receive attention.

The division which is most widely applicable here is into two classes of cases having totally different pulse tracings.

The first class of maniacal patients has active cutaneous circulation with warmth and color of skin and the pulse about normal or slightly increased in frequency. The sphygmogram in these cases has a vertical ascent, a sharp apical angle, the predicrotic wave and notch almost disappear and the aortic notch and dicrotic wave are strongly marked.

The second class of maniacal patients has pallor and coolness of the cutaneous surfaces and a pulse of much higher tension. The percussion wave has a less sudden ascent, a less acute angle, and the descent is more gradual, with a distinct tidal wave and an obscure aortic notch and a scarcely perceptible dicrotic wave. Even these two types of pulse are not often permanent throughout an attack of mania, and they may follow each other, or, in rare instances, be interchangeable in the same case.

In the first class of cases,—when the excitement is very great, the pulse may become tricrotic, and in the second class of cases,—when exhaustion is very decided, the pulse becomes monocrotic. In all cases of mania the state of the emotions, as well as the physical condition, is to be taken into account. The etiology of the case is also of importance. Puerperal maniacs, having lost a considerable percentage of their vital fluids, may present the pulse of empty arteries and post-febrile maniacs may have subnormal temperature and an exaggerated tricrotic pulse. Mania with Grave's disease may give anacrotic tracings, as shown here in one of our sphygmograms. Anacrotism is also found in alcoholic mania with atheromatous arteries.

As a rule, all the toxicmanias have a high tension pulse, the tidal wave often rising to form a plateau with the apex of the primary wave. In alcoholic cases the state of the liver and of the kidneys exerts a modifying influence, as does the condition of the lungs in phthisical cases. In the latter instance there may be a typical pyrexial pulse tracing and the relation between pulse and temperature may or may not be lost. In phthisis the mental disorder is often most active when the pulmonary disease is stationary and there is then a high tension pulse, and dicrotism only returns with an advance in the pulmonary lesions. The high innervation and muscular activity of maniacs favors easy circulation and dicrotism,

but when excessive exertion leads to exhaustion the pulse becomes monocrotic. Also when maniacal muscular efforts, continued for some months, have led to ventricular hypertrophy there is also a permanent secondary modification of the pulse tracings, which become still more complicated if, as is not unfrequently the case, cardiac valvular lesions develop in these cases of prolonged and intense stimulation of cortical motor centres.

In mania and in all acute forms of insanity pathological states of the blood are of great importance in their relation to sphygmographic studies. In all acute cases with foul secretions and excretions, and in all auto intoxications the pulse tracings are abnormal to the degree of the toxic condition. The rule in these toxic cases is a pulse of high tension, often with a sustained rectangular apex formed by the blending of the percussion and predicrotic waves, while the dicrotic wave disappears and the smaller diastolic elastic vibrations may be present. That qualitative and quantitative changes in the blood affect the pulse trace is well known, and the same patients will sometimes give different sphygmograms accordingly as they are taking alkaline or acid remedies. Such a common remedy as phosphoric acid will cause a variation in the pulse trace. The study of blood changes in insanity is rapidly advancing. In the light of future knowledge it will doubtless be possible to formulate some rules as to sphygmographic tracings in all toxic insanities.

To turn now from states of exaltation to those of depression, let the sphygmographic character in some forms of melancholia next be considered.

In the vast majority of cases of melancholia there is mental inhibition, muscular contraction and vascular spasm, and as might readily be surmised, therefore, the average resulting pulse is one of high tension. The ascent is not high; there is an early tidal wave, and the descent is gradual, with scarcely a perceptible trace of aortic notch or dicrotic wave. In great physical depression, with feeble systole, the percussion wave is small and the catacrotic elevations completely disappear. In senile melancholia the high tension pulse is due to atheromatous and other vascular changes rather than to spastic states of the arterioles, and in alcoholic melancholia likewise the sphygmographic signs of peripheral resistance arise more frequently from arterial degeneration than from angiospasm.

The high tension pulse of the autointoxications deserves notice again in this connection and the relief afforded by diaphoretic diuretic laxative and hydrotherapeutic measures which markedly modify the tracings. On the other hand there are whole classes of melancholiacs with a low tension pulse.

Melancholia originating directly from cerebral exhaustion, and indeed from all forms of neurasthenia gives signs of low arterial tension.

Another kind of melancholia having a low tension pulse is that which originates directly from hypochondria as a neurosis. The same low tension is found at times in chlorotic and other diathetic states. In phthisical melancholia this is also true whenever there is pyrexia, which often yields a markedly dicrotic tracing which characterizes also tubercular melancholia with basal meningitis. Some of my hearers, like myself, may have studied with Meynert of Vienna and may well remember his demonstration of cases of melancholia with basal meningitis, which are less commonly found here.

In general it may be affirmed that a continued low tension pulse in melancholia is of bad prognostic significance. The most marked changes in tension and in other graphic characters of the pulse are seen in the transition from the depressed to the elated state of circular insanity and also in melancholia with maniacal exacerbations and in cases of stupor with semi-maniacal recurrences. It is possible, as a clinical experiment in melancholia attonita, to transform a monocrotic pulse of high tension into a dicrotic pulse by drugs and stimulants, or even by so simple a means as a prolonged hot bath. The Turkish bath is especially effective, as some years ago described by the writer, in relieving venous stasis and various angiospastic conditions which accompany a high tension pulse in forms of melancholia.

Acute attacks of precordial panic in melancholia have a pulse marked by frequency, small volume and intravascular pressure, giving a low ascent and sustained descent and disappearance of catacrotic elevations, except occasional elastic vibrations. In fact, depressive delusional states of acute mental anxiety, in women especially, with great frequency of pulse often give a monocrotic tracing with a slight percussion wave and entire obliteration of other sphygmographic characters. In stuporous and cataleptoid conditions a similar tracing often appears, with loss of the diastolic features, and the

substitution of a simple gradual line of descent. A similar tracing may appear in cases of slowed pulse from puermogastric irritation. A great variety of accidental features appear in the sphygmograms of melancholia, as in those of other forms of insanity, from intercurrent cardiac affections.

The cardiac affections found in the twenty-one hundred and seventy-two cases of insanity may be briefly summarized as follows. Irregularities of heart's action in five per cent., intermittance in two per cent., heart murmurs and heart lesions in eight per cent. Mitral murmurs and lesions prevailed in the melancholia cases and brought a variety of corresponding pulse tracings, mitral regurgitation being the most frequent of these affections.

In cases of heart disease in mental disorders the sphygmographic records are not as a rule as typical of the cardiac lesion as in cases uncomplicated with insanity.

Attention must now be given to the pulse tracings in the secondary and terminal stages of mental disease embraced under the general term dementia.

When patients have been swept by the violent storms of acute insanity and left permanent human wrecks, it will be found that their vital machinery has been damaged in various ways. Some have wasted brains, others disease of the great sympathetic system; some are left with hypertrophy, dilatation or valvular disease of the heart and others with general vascular degenerations; some have chronic pulmonary complaints and others cirrhotic livers or granular kidneys, while still others, escaping all these complications, appear simply to have lost the essential and harmonizing control of the intellectual and emotional centers over all the functions of the human economy.

It is not to be expected, nor is it found to be a fact, that these widely varying and pathologically constituted demented should present any one characteristic pulse tracing. It is true that all departures from tricotism, as the normal standard of the radial pulse tracing, are apt to be in the direction of simplicity, and that some form of the dirotic or monocrotic pulse naturally results in dementia. It is also true in this terminal stage that there is apt to be in the circuit of the blood some obstruction by a diseased internal organ, or some peripheral resistance from vascular changes, which gives as a rule a pulse of high tension. The following description

of a sphygmogram would apply to a considerable percentage of terminal dements. The ascent is gradual and below medium height, the apex is rounded or formed in variously sustained shapes by the help of an early and imperfectly developed tidal wave, the descent is gradual and shows some wavelets, but no distinct aortic notch or dicrotic wave.

One cause of the gradual line of descent in the sphygmograms of many dements is permanent exhaustion of the sympathetic nervous system, and the resistance which arises from venous stasis, as is shown by the cyanotic extremities of these patients and sometimes by a bluish tint of the whole bodily surface. Lunatics as a rule are psychically indifferent, but physically very susceptible to the action of heat and cold. This is due to feeble vasomotor innervation and the sphygmographic tracings will vary exceedingly according to the state of the atmosphere and of the surrounding temperature.

Immerse the arm of one of these patients in hot water and there will follow an alteration in the tracing, and a hot bath will have a still more decided effect.

In alcoholic dementia the resistance which gives rise to the high tension pulse may be in cirrhotosed liver or kidneys, or sclerosed nervous centers. In senile dementia on the contrary it is attributable to atheromatous vascular changes, and in syphilitic dementia to the resulting arterial degenerations. Primary dementia again gives a tracing ordinarily of high tension, which is due to vasomotor paresis: but in some cases there is a distinctly dicrotic pulse.

In terminal dementia there is sometimes a species of restitution to a normal standard of the physical man, and there may be an apparently natural tricrotic pulse in these cases, and a dicrotic tracing is also not uncommon. It not infrequently happens also that some chronic cardiac complication in these terminal cases imparts its own peculiar character to the tracing.

Some of the varieties of sphygmograms in terminal dementia are here shown as taken from among my patients. The tracings were first made on enamelled paper and were then photographed and mounted as you here see them. The variety which characterizes the tracings of the acute stages of insanity is to a considerable degree still present in this terminal phase of the disease in which if ever, uniformity would be expected.

It would not do to dismiss this subject of the pulse tracings of

dementia without some notice of the sphygmographic characters of parietic dementia.

In the earliest stage of general paresis the pulse may be tricrotic, and, if the expansion reaches a maniacal degree, dicrotic. There is usually, however, a decided failure of systolic force as the disease advances, and the general angioparesis progresses rapidly after the first stage, so that there are soon developed various forms of high tension pulse from peripheral obstruction.

Endarteritis in the syphilitic and alcoholic cases often causes this resistance to the flow of blood, giving tracings which vary considerably within the limits of high tension. The percussion wave is usually low with rounded apex, and the descent has numerous wavelets and not infrequently vibrations due to tremors peculiar to the disease.

The apex in other tracings is rectangular, the plateau being formed by help of the tidal wave and the aortic notch and dicrotic wave do not appear. Following a series of parietic convulsions, however, the tracings may be dicrotic, or even hyperdicrotic, if the temperature reaches a high degree. In the final stage the monocrotic type of pulse prevails, though bed-ridden cases sometimes give anarrotic tracings. In this third stage it is also quite possible to find an ascent with an acute angle and a sudden descent. In fact, there is nothing more surprising than the sudden variations in the pulse tracings of general parietics, and this is perhaps due in part to the variety of ways in which the cortical vasomotor and pneumogastric centres become involved with the advance of the disease.

In tabetic or ascending cases of general paresis the tracings from the first are those of high tension and usually so continue to the last stage.

Finally, it cannot be denied that in the forms of paresis with continued depression there may be a pulse of low tension and that in rare instances parietics throughout nearly the whole of the first and second stages of the disease give pulse tracings that are apparently about normal.

It would exceed the intended limit of this paper to study in detail the sphygmographic characters of circular and epileptic insanity, of katatonia, or paranoia and of all the special forms of mental disease, including imbecility and idiocy. This will be done in a second

article devoted to this subject, and haste is now made to summarize the main conclusions of this paper, which are as follows :

There is a considerable increase in the frequency of the pulse in both sexes in confirmed cases of insanity. Intermittance and irregularity of the heart, cardiac murmurs and valvular lesions are found in about ten per cent. of all established cases of mental disorders.

Abnormal sphygmographic tracings are to be found at some stage of the disease in the vast majority of cases of insanity. They are due to affections of the cortical and spinal motor and vasomotor centres, to various lesions of the sympathetic, to disorders of the pneumogastric, to peripheral and central vascular changes, to degenerations of central organs, to toxic agents in the blood, to auto-intoxications, to cachectic and diathetic conditions, to cardiac lesions and to a great variety of intercurrent causes.

These abnormal pulse tracings vary much in different kinds of insanity, and in different individuals suffering from the same form of mental disorder, and they are best classified according to the actual physical status of the patient, and the etiology and stage of the mental disorder. No one sphygmogram is pathognomic of any particular form of insanity, but there are certain general types of tracings which are found in one form of mental disease and not in another. Sphygmographic studies, to be of special value, should be continued in the same patients throughout an attack of mental disorder, and tracings finally obtained in convalescence should be preserved for comparison. Unfortunately studies with the sphygmograph are laborious and time-consuming, but they are of such diagnostic and prognostic value in mental disorders that they have already become an indispensable part of alienistic science.

If this study of the pulse in insanity, made in the odd moments of a busy life, shall encourage like clinical research on the part of others, it will have served its chief purpose.

I desire in conclusion to acknowledge the valuable aid rendered in these pulse studies by members of my medical staff, by Dr. Mel-
len, Dr. Currie, Dr. O'Hanlon, Dr. Bowlby, Dr. Sanborn, Dr. Doran and Dr. Wheeler, and in particular by Dr. Frost, my first assistant, in the preparations of the pulse tracings.

